junction cells could manage power coming from a single junction or an aggregate of similar junctions, within a sub-array of multi-junction cells. It also should be noted that a single element within a multi-junction cell could be either a single junction or perhaps a subset or multiple being two (or more) junctions connected, for example, in series to make one element of a larger, for example, six-junction multi-junction cell. As another example of a multi-junction cell, consider one that has a total of five junctions, where various subsets of the junctions are independently coupled to a multi-junction power manager circuit **14**. For instance, such a 5-junction cell can be arranged as follows: a 2-junction sub-cell connected separately (to the circuit **14**) from a 1 junction sub-cell and another 2-junction sub-cell. Other arrangements of multi-junction cells that may have series and/or parallel connected subsets, i.e. connected to its respective power manager circuit **14**, are possible.

[0033] In one embodiment, referring now to FIG. **8**, the power manager circuit **14** may be composed of a power detection circuit that serves to detect some measure of the relative power being produced at any given time by the junctions A, B, and C. For example, the detector may be designed to automatically detect which one or more of the junctions are producing the lowest power. In response to such a determination, the PV cell **3**, and in particular its power manager circuit **14**, will operate in a predetermined mode. As an example, that mode may be one where control signals are asserted to configure the current path switches so that the junctions producing the lowest power become disconnected from the cell output port.

[0034] In another example, the detector may be designed to automatically detect which one or more of the junctions are producing the highest power, in response to which the cell **3** will operate in a different predetermined mode. As an example, that mode may be one where control signals are asserted to configure the current path switches so that only the junctions producing the highest power become connected in series with the cell output port. In another embodiment, the cell or multi-junction power manager circuit **14** has a communication interface through which it can be programmed (via the communication grid **9**) so as to connect the photocell junctions, which make up its associated multi-junction PV cell or group of such multi-junction PV cells, either a) all in parallel with each other, b) all in series with each other, or c) in some series-parallel combination.

[0035] It should be noted that the cell or multi-junction power manager circuit **14** and its associated multi-junction PV cell **3** could be implemented on the same microelectronic or integrated circuit substrate.

[0036] Referring now to FIG. **9** and to FIG. **10**, these figures are used to illustrate another embodiment of the invention, where the PV system can maintain a predetermined system output voltage or system output power level despite the presence of a wandering laser light beam or incoherent light beam illumination spot. A similarly beneficial result may be obtained in situations where there is a partial shading of the sub-arrays **2**. The PV system depicted here is being illuminated with a laser or incoherent beam (not sunlight), or can be viewed as being shaded outside the illumination spot. Examples of these circumstances are given in FIG. **11** where remote power transfer is occurring to a power receiver or PV system of an aircraft or spacecraft, via a remotely produced light beam that is being aimed at the sub-arrays **2**. To maintain efficiency, the beam spot should be no larger than the area of the sub-arrays **2** of the PV system. In fact, the spot should be smaller than the full area of coverage of the sub-arrays **2** (as shown by the example) to allow for adequate misalignment tolerance between the remote light beam source and the PV array. In traditional PV systems, illuminating less than the full area of the PV array leads to reduced performance and possibly damage to the array. However, an embodiment of the invention can accept a laser (or other light) spot size that is less than the full area of the PV array. This illumination situation will yield some low performing sub-arrays **2** outside the spot, and some high performing sub-arrays **2** inside the spot. Now, the EPS controller **8** programs the power manager circuits **14** of the low performing sub-arrays to disconnect them from the power grid, in response to, for example, a signal from the power detector (see FIG. **8**) that is associated with a multi-junction cell in each of those sub-arrays that indicates low performance by a multi-junction cell in the sub-array. Alternatively, the power manager circuit **14** could have a DC-DC voltage boost converter that allows the partially illuminated or low performing sub-arrays to connect with the power grid, at the appropriate voltage. The power situation would need to be one where the power output from that circuit **14** doesn't need to match the grid power, but its voltage output level does need to match, for the sub-array to be connected to the power grid. In addition, the EPS controller programs the power manager circuits **14** of high performing sub-arrays to connect them to the power grid, in response to a signal from the power detector associated with a multi-junction cell in each of those sub-arrays that indicates high performance by a multi-junction cell in the sub-array.

[0037] In another embodiment, the EPS controller **8** signals each of the power manager circuits **14** to connect their photocell junctions in series with each other in response to a determination that the PV system is most likely feeing sufficient sunlight, so that efficient energy harvesting can be performed when the current characteristics of the different junctions sufficiently match during sunlight. But when it is determined that energy harvesting is based on a laser light beam or an incoherent light beam (not sunlight), then the process described below can be performed to disconnect the junctions that are not optimized for the color or wavelength of the light beam, and also to track the wandering beam spot so that an optimal selection of a subset of the sub-arrays is always being made (consistent with the coverage area of the beam spot).

[0038] A method for operating an energy harvesting photovoltaic (PV) system having energy harvesting sub-arrays, cell power management circuits, sub-array power management circuits, and a programmable power grid, may proceed as follows (with references being made also to FIG. **9** and FIG. **10**). A number of performance indications are received (e.g., by the EPS controller **8**) from certain cell power manager circuits **14**, respectively (see also FIG. **7** and FIG. **8**). The controller **8** then signals the power manager circuits **14** of low performing sub-arrays to disconnect those sub-arrays from the power grid. In addition, the controller signals the circuits **14** of high performing sub-arrays to connect those sub-arrays to the power grid. Also, the controller **8** signals the bus management circuits **5** (see FIG. **1**, and also FIG. **2** and FIG. **3**) to form power paths in the power grid, from the connected sub-arrays to the pair of harvested energy output nodes of the PV system **1**, based on the received performance indications. This may be designed to achieve a predetermined system output voltage or system output power level.